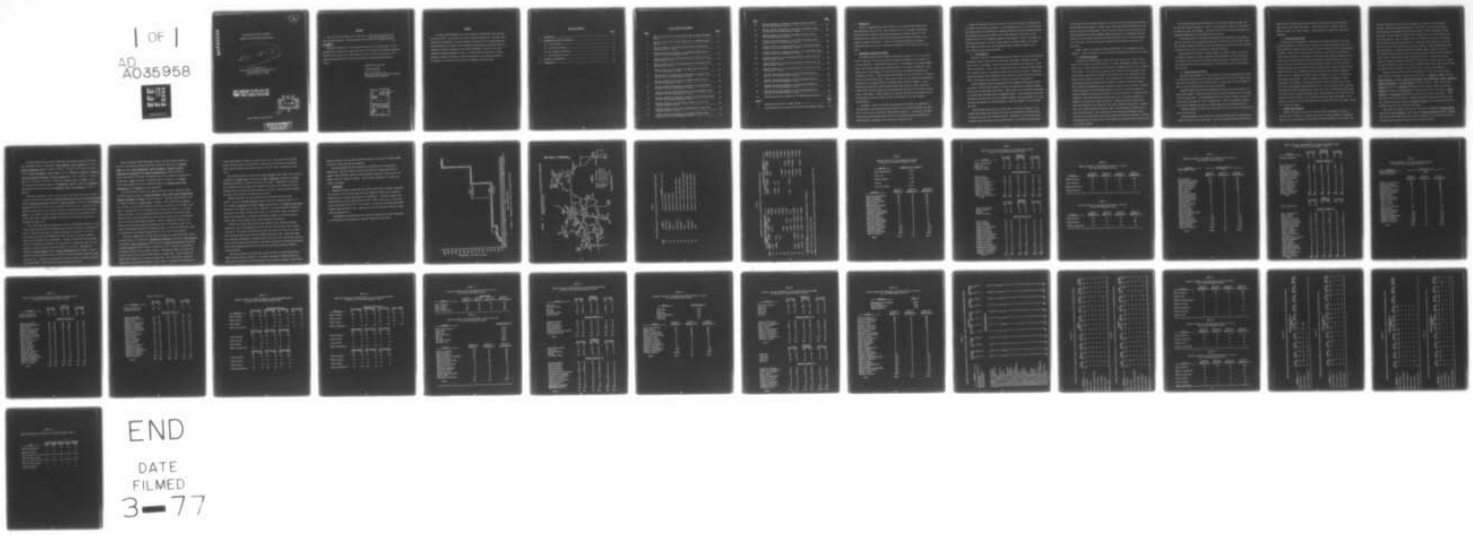
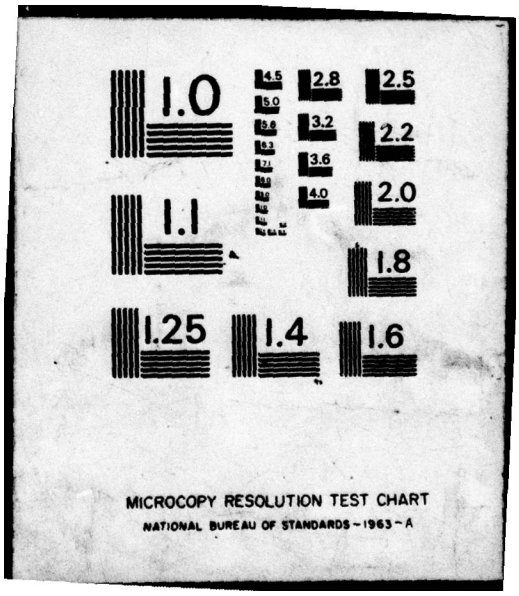
AD-A035 958 IIT RESEARCH INST CHICAGO ILL F/G 6/18
AN ECOLOGICAL SURVEY OF PLANTS EXPOSED TO ELF ELECTROMAGNETIC F--ETC(U)
NOV 76 G M ROSENTHAL N00039-71-C-0111
UNCLASSIFIED NL



END

DATE FILMED 3-77


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A

(6)
B.S.

AN ECOLOGICAL SURVEY OF PLANTS EXPOSED TO ELF ELECTROMAGNETIC FIELDS

See 1473

G. M. Rosenthal, Jr.
Biological Sciences Collegiate Division
The University of Chicago
Chicago, Illinois 60637

FINAL REPORT, NOVEMBER 1976

FOREWORD

This study was performed under subcontract to IIT Research Institute for the U.S. Naval Electronic Systems Command under Contract No. N00039-71-C-0111, IITRI-E6185.

The author thanks Dr. F. J. McCormick, University of North Carolina, for his assistance in selecting the study sites and for his direction of community analysis. Thanks is also given to Mr. David Benson of the U.S. Forest Service and to IIT Research Institute personnel for their assistance and cooperation during the survey.

Respectfully submitted,

Dr. G. M. Rosenthal, Jr.
Biological Sciences Collegiate Division
The University of Chicago

SUMMARY

A survey of the vegetation near the antennae at the Wisconsin Test Facility was made in 1971. This facility is used in testing extremely low frequency (ELF) communication techniques. The main purpose of the survey was to obtain quantitative descriptions of several forest ecosystems and herbaceous ecosystems near the antennae as baseline information for future assessment of impact on the flora exposed to ELF electromagnetic fields. Analysis of the data revealed a normal pattern of species composition, species distribution, and community structure. No indication of effect from the ELF electromagnetic field was noted.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

1. INTRODUCTION

A survey of vegetation near the antenna at the Wisconsin Test Facility was made during the summer of 1971. This survey was part of a program to determine possible biologic effects of ELF electromagnetic environments similar to those envisaged in the vicinity of the Navy's proposed ELF Communication System, e.g., *Projects Sanguine and Seafarer*. The data are intended primarily as baseline information that can be used to assess the conditions of the flora at some future time.

2. EXPERIMENTAL DESIGN AND METHODS

The Wisconsin Test Facility (WTF) antenna array includes a 14 mile long north-south antenna and a 14 mile long east-west antenna positioned so that they cross at their midpoints. Transmission frequency is in the extremely low frequency (ELF) range. The antenna right-of-way was established in the winter of 1968-1969. Test operations at the WTF began on 21 July 1969 with the N/S antenna energized with 10 amperes of current. The E-W antenna was energized for the first time on 7 August 1969 at the same current level. The current in each of the antennae was periodically increased to a 50 ampere level by 15 November 1969 as shown in Figure 1. Both antennae were operated at the 150-ampere level starting on 15 October 1970 until 1 March 1971, when the current in both antennae was increased to the maximum current level of 300 amperes. Since 1 March 1971, the Test Facility has been operated with 300 amperes of current in either the N/S or E/W antenna or in both antennas simultaneously.

In general, since 21 July 1969, the Sanguine Test Facility was operated on a five-day week, six hours-per-day test schedule at an operating frequency of either 45- or 75 Hz, and at the current levels shown in Figure 1. In addition, the Test Facility was operated with either the N-S or E-W antenna operated separately or simultaneously, depending on the test plan for each test day.

Specific objectives of the survey were 1) to obtain quantitative descriptions of several forest ecosystems adjacent to the Sanguine antenna 2) to obtain quantitative descriptions of the herbaceous ecosystems which have become established within the Sanguine antenna right-of-way), 3) to census apical bud mortality in pine forests adjacent to the Sanguine antenna to study possible effects of ELF radiation upon plant populations, and 4) to repeat each of the three studies listed above near commercial 60 Hz power lines relatively near the Sanguine antenna and in areas remote from the Sanguine antenna.

2.1 Site Selection

The WFT is located in the Chequamegon National Forest near Clam Lake, Wisconsin. Chequamegon National Forest Timber survey maps were used to identify the chief forest types in the region. Major forest types identified were spruce-fir, mixed northern hardwoods, a lesser extent of pine plantations, successional aspen stands, and a variety of small transitional forests such as elm-ash ecotones. Spruce-fir and mixed hardwood forests predominate and, therefore, were selected for intensive study. Pine forests were selected for analysis of apical bud mortality.

Three different forest sites adjacent to the Sanguine antenna were selected for study. One site was a spruce-fir forest, the second was a northern hardwood forest, and the third was a pine forest. Three similar sites were selected adjacent to a power line relatively near the Sanguine antenna. Three additional sites were selected in an area remote from the Sanguine antenna, two being adjacent to a power line and one adjacent to a buried pipeline. The total number of sites surveyed was nine.

To the extent possible the six forest sites not directly adjacent to the antenna were chosen along rights-of-way that were established at approximately the same time as the Test Facility antennae. Therefore two of the three sites relatively near the antenna were located adjacent to the WTF 60 Hz prime power

line and the third was located adjacent to a buried 60 Hz power line which services the WTF mobile radio repeater. These rights-of-way were established about the same time as the antenna installation. One of the three sites far from the antenna was located adjacent to a buried pipeline right-of-way which was established about the same time as the antenna right-of-way and the remaining two were located adjacent to a 60 Hz power line which had been in operation since before the antenna was installed.

Figure 2 shows the location of each site relative to the antennae and local landmarks. Table 1 summarizes the site location classifications used in this report.

2.2 Sampling Procedures

A transect was established in each of the nine forest sites. Each transect began in the middle of the right-of-way, i.e., under the Sanguine antenna, under a power line, or above a pipeline, and continued out perpendicular to it for a distance of 106 meters. Six consecutive one square meter quadrats were established along each transect beginning in the middle of the right-of-way and terminating at the forest ecotone (edge of the forest). Ten consecutive 2 x 10 meter quadrats were established along the remainder of the transect to sample the forest ecosystem. This procedure was duplicated along a parallel transect at each location to provide replicate quadrats at each distance giving a total of 12 one meter quadrats for sampling herbaceous vegetation and twenty 2 x 10 meter quadrats for sampling forest ecosystems. The single exception was that only ten 2 x 10 meter quadrats were sampled in the spruce-fir power line forest. Vegetation here was sufficiently dense and homogeneous that additional plots were considered unnecessary. Quadrats were in all cases distributed linearly along a distance gradient extending away from the right-of-way so that comparisons can be made with subsequent surveys. All plants in the one square meter quadrats were identified and counted. All trees exceeding one inch in diameter at breast height were identified and counted in the 2 x 10 meter quadrats.

The hardwood forest Site C8 transect not only commenced under the power line but was also within 10 meters of a road. At the spruce-fir forest Site C7 grasses had been sown under the antennae. This was not done at Site C8 and, therefore, the herbaceous vegetation was much more weedy in character.

In the pine forests a transect was established perpendicular to the right-of-way for a distance of 100 meters for white pine and 50 meters for red pine. Within each 10-meter segment ten pine trees were selected and ten apical buds were inspected on each tree for a total of 1,000 buds along each transect.

This experimental design is similar, though on a smaller scale, to a series of studies conducted in similar ecosystems near Rhinelander, Wisconsin where the U.S. Forest Service exposed the forests to gamma radiation. Preliminary results from the Rhinelarder studies were helpful in conducting the work at the Wisconsin Test Facility.

2.3 Data Analysis Procedures

Data from each herbaceous or forest quadrat were analyzed separately in order to characterize change along the distance gradient from the antenna or power lines. Data from all herbaceous or all forest plots at a given site were also grouped in order to obtain a description of the entire ecosystem.

Relative density and relative dominance were calculated for each species in each forest quadrat. These two statistics plus relative frequency were calculated from the grouped data. In the herbaceous plots some grasses, sedges, and clovers could only be described in terms of percent cover. The sum of relative density and relative frequency was used to estimate importance of herbaceous species.

Percent mortality of apical buds was calculated for each 10 meter interval and also for each forest.

Photocompensation point studies were conducted according to the techniques of Lieth[1] on samples of fir, sugar maple, and aster collected from the center of the

rights-of-way. Three samples of each species from the three sites were placed under each of four light intensities: 6,000-foot candles, 1,600-foot candles, 600-foot candles, and 0-foot candles. Temperature was recorded under each set of conditions.

2.4 Electromagnetic Field

Representative measurements of the electric and magnetic fields due to Test Facility operation at either 45 Hz or 75 Hz and the normal operation of the 60 Hz power systems were made at each location to give an indication of the electromagnetic treatment. Each site may be classified according to the types of Test Facility fields which exist there. For example, the sites located directly adjacent to the antenna have relatively large electric and magnetic fields, the sites adjacent to power lines near the antenna have electric fields but nearly no magnetic fields, and the sites far from the antenna have very small electric fields and even smaller magnetic fields. For the purposes of identifying the sites they are designated Type A, B, or C, depending on whether they are adjacent to, near, or remote from the antenna, respectively. Table 2 presents the electric and magnetic fields measured at the locations. The measured electric field levels at site A1 at 45 and 75 Hz are relatively high because this site is near an antenna ground terminal. The measured electric field levels at site B6 and 75 Hz are relatively high because this site is near a buried 60 Hz power line. The buried power line causes the 75 Hz electric field to be higher in its vicinity because the power line sheath is the neutral in contact with the earth which acts as a ground for the 75 Hz signal coupled to it from the antenna.

3. RESULTS AND DISCUSSION

Species diversity and species distribution were investigated in order to estimate local diversity, to compare sites, and to evaluate adequacy of sampling. When 12 plots were censused, all the species had been included in the sample; and

when 600 individuals at each site were sampled, all species at that site were included. Additional sampling revealed no new species. The species diversity also reflected environmental discontinuities obvious to the investigators during the study. Directly under the power line or antenna there are many individuals of only a few species. This is because clover or a mixture of rye grass, blue grass, and fescue were planted under the wires. Accordingly, few species are present up to the limit of the area planted with clover or grasses. Many weedy species occupy the area between the planted species and the forest edge. Close to the forest, many species typical of the forest floor appear and add to the diversity (richness) of the flora. Three distinct zones of vegetation occur: 1) grasses or clover planted by machine following installation of the antenna or power line, 2) a transition area inhabited by weedy species, and 3) predominantly forest floor species along the edge of the surrounding forest. This pattern is normal and predictable.

Dominant species which have become established at Site A1 where the antenna right-of-way cuts through a spruce-fir forest include: Trifolium repens (clover), Carex pensylvanica (sedge), Hieracium aurantiacum, Rumex acetosella, Cornus canadensis, Uvularia grandiflora, and Rubus indaeus as shown in Table 3. Table 4 shows that Trifolium (clover) and Hieracium dominated the plots directly under the antenna. Trifolium was planted and Hieracium is a typical weed found in open areas. Cornus, Uvularia, and Maianthemum dominated the areas along the edge of the forest. These are typical forest floor species. Between the clover planting and the forest ecotone (edge) the dominant species were Rumex and Rubus, both common weeds typical of roadsides and fence rows throughout the region.

The forest surrounding the antenna at this site is dominated by Abies balsamea (balsam fir), Acer saccharum (sugar maple) and Betula papyrifera (birch). Although U.S. Forest Service maps indicate the area was spruce-fir, the specific site was a fir forest with scattered maple and birch as shown in Table 5.

At Site B4 where the power line right-of-way cuts through a spruce-fir forest, the surrounding forest is dominated by Abies balsamea, Picea mariana (spruce), and Populus tremuloides (aspen) as shown in Table 6. Dominant species below the power line are Carex pensylvanica, Viola pallens (violet), Maianthemum canadense, Equisetum sylvaticum, Fragaria virginiana and Aster macrophylla as shown in Table 7. Directly under the line the cut over area is dominated by Carex, Viola, and Rubus. Along the forest ecotone dominant species are Maianthemum, Anemone, Aster, and Lycopodium. Intermediate areas were dominated by Equisetum, Viola and Maianthemum as shown in Table 8

Herbaceous vegetation at Site C7 where a power line right-of-way goes through a spruce-fir forest was dominated by Lolium multiflorum (Rye grass); Carex pensylvanica (sedge); Hieracium aurantiacum (Hawkweed); Cornus canadenis (Dogwood); and Maianthenum canadense (False Lily of the Valley) as shown in Tables 9 and 10. Rye grass is of greatest significance directly under the power line and had obviously been planted. Carex is most important midway between the dense rye grass and the shaded ecotone at the forest edge. Hawkweed, dogwood and false lily of the valley were found throughout the open area.

All of these most important species were also of considerable importance in the antenna right-of-way at Site A1 except Rye grass which was replaced by plantings of clover. Sites A1 and C7 share in common an additional six species. Site C7 is more moist than Site A1 and differences between floristic composition probably reflect this difference in site character. A degree of similarity exists between Sites C7 and character of Site B4. This site was not a spruce-fir forest but was actually a cedar-fir forest as shown in Tables 11, 12 and 13. The forest is dominated by Abies balsamea (fir) and Thuja occidentalis (white cedar). A more upland site was unsuitable because a road went through herbaceous vegetation under the power line. Although forest composition differs from that of Site A1, Site C7 is a better model of Site A1 than the area disturbed by the road.

Where the antenna right-of-way goes through a northern hardwood forest at Site A2, the ecosystems directly under the antenna are dominated by Trifolium repens (clover), Carex pensylvanica, Aster macrophylla, Plantago rugellii, Chrysanthemum leucanthemum and Anaphilis margaritacea as shown in Table 14. Clover dominated directly under the antenna where it was seeded following antenna installation. Carex increased in importance near the ecotone, as did Aster. In the intermediate area the most important species are Cirsium muticum, Poa, Chrysanthemum, and Anaphilis as shown in Table 15.

At Site B5 where the power line right-of-way goes through a hardwood forest, the most important species are Aster macrophylla, Rubus idaeus, Rubus allegheniesis, Fragaria virginiana and Carex as shown in Table 16. Directly under the power line the dominant species are Carex, Aster, and Rubus. Aster predominated throughout the transition to the forest ecotone but decreases in importance at the edge of the forest. Poa grew best in the intermediate zone as shown in Table 17. As in the spruce-fir forests, the chief difference between successional ecosystems in the hardwood forests under the antenna and those under the power line was the excellent stand of clover planted under the antenna. Species composition, diversity, and density are in every way typical of open areas which are invaded by weeds. The closer one progresses toward the surrounding forest, the fewer old field-type weeds are encountered, while species characteristic of the forest floor increase.

Herbaceous vegetation at Site C8 where the power line right-of-way goes through a hardwood forest is dominated by Calamagrostis canadensis (reed grass); Poa pratensis (blue grass); Aster macrophyllus (big leaf aster); Hieracium aurantiacum (hawkweed); and Viola pallens (violet) as shown in Tables 18 and 19. There was no significant distribution pattern to the dominant species. This perhaps reflects the fact that neither grasses nor clover were seeded under this power line. A great variety of weedy species comprises the herbaceous vegetation. This site shares 8 species in common with hardwood Site A2 adjacent to the antenna. Hardwood Site B5 adjacent to

a power line shares 11 species in common with Site C8. The large number of weedy species reflects effects of the adjacent roadbed and the absence of a competitive clover and grass species which were planted under power lines or antennae at other sites.

This hardwood forest was dominated by Acer saccharum (sugar maple) with scattered individuals of Betula lutea (yellow birch), Ostrya virginiana (ironwood), and Tilia americana (basswood), as shown in Tables 20, 21, and 22. Composition is similar to that of hardwood Site A2 except that basswood and birch are more important in Site C8 while red oak and aspen are more important in Site A2. This may reflect slightly more xeric (drier and warmer) conditions in Site A2.

Species composition of the hardwood forest at Sites A2 and B5 is quite similar. At both sites Acer saccharum (sugar maple) is the dominant species. At Site A2 Ostrya virginiana (ironwood), Quercus rubra (red oak), and Populus tremuloides (aspen) are also significant as shown in Table 23. At Site B5 species of additional significance are aspen, ironwood, white pine, fir, and birch as shown in Table 24. There is no significant or consistent distribution pattern of any species within either forest type at either site as shown in Tables 25 through 28.

Mortality of apical buds of white pines showed no clear difference between populations close to the antenna at Site A5 and those some distance away as shown in Table 29. The same is true for Site B6 near the power line where it was obvious that most bud mortality was due to the death of white pine buds. White pine buds are notoriously susceptible to diseases which kill apical buds, and the data actually reflect the frequency with which white pines were encountered in red pine plantations. There was no detectable pattern of pine bud mortality which could be related to antenna operation.

The red pine forest at Site C9 near a pipe line had very little mortality of terminal buds as shown in Table 29. The higher percentage of dead buds near the power line at Site B6 were almost exclusively buds in direct sunlight in open areas.

Percent mortality is so low that nothing more than a trend toward slightly higher mortality in open areas can be identified.

The photocompensation point studies were complicated by fluctuations in temperature. The only results are that at 26°-28°C the compensation point of Aster is below 600-foot candles and the compensation points of maple and fir are between 600- and 1,600-foot candles. The data were insufficient to obtain any useful information.

4. CONCLUSIONS

Analysis of species composition and relative importance of species comprising the forests and the cut over areas below the antenna and power lines revealed a normal pattern of species composition and distribution. Community structure was quite similar at antenna sites and other sites. Dense populations of clover and grasses were found directly under the antenna. Similar but less dense populations occurred under the power lines. These populations were planted in order to insure effective ground cover.

Installation and operation of the antenna has apparently not been detrimental to the composition and structure of natural communities in the area.

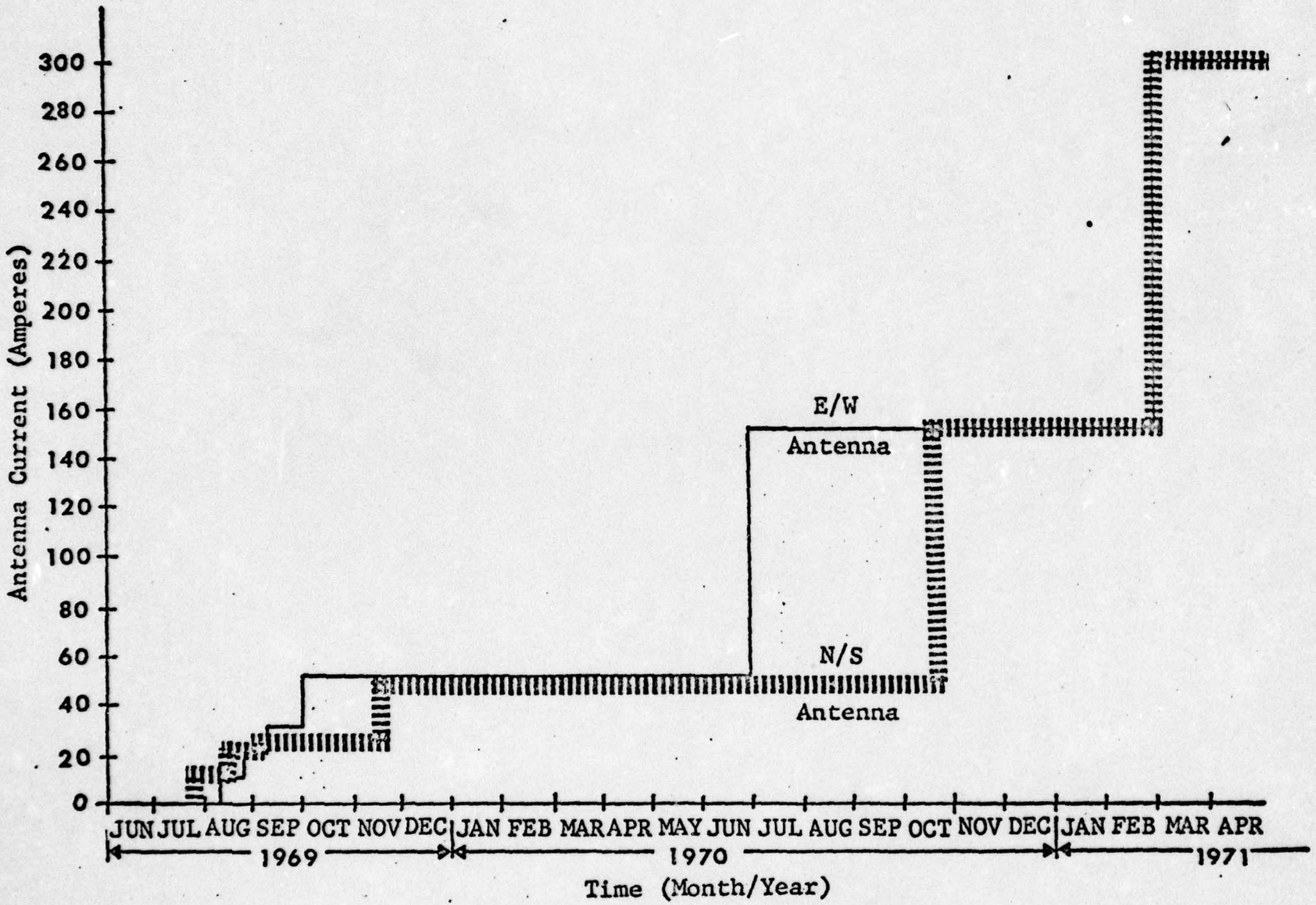


Figure 1 Wisconsin Test Facility Antenna Current

Figure 2 Site Location for the Wisconsin Test Facility Ecological Survey

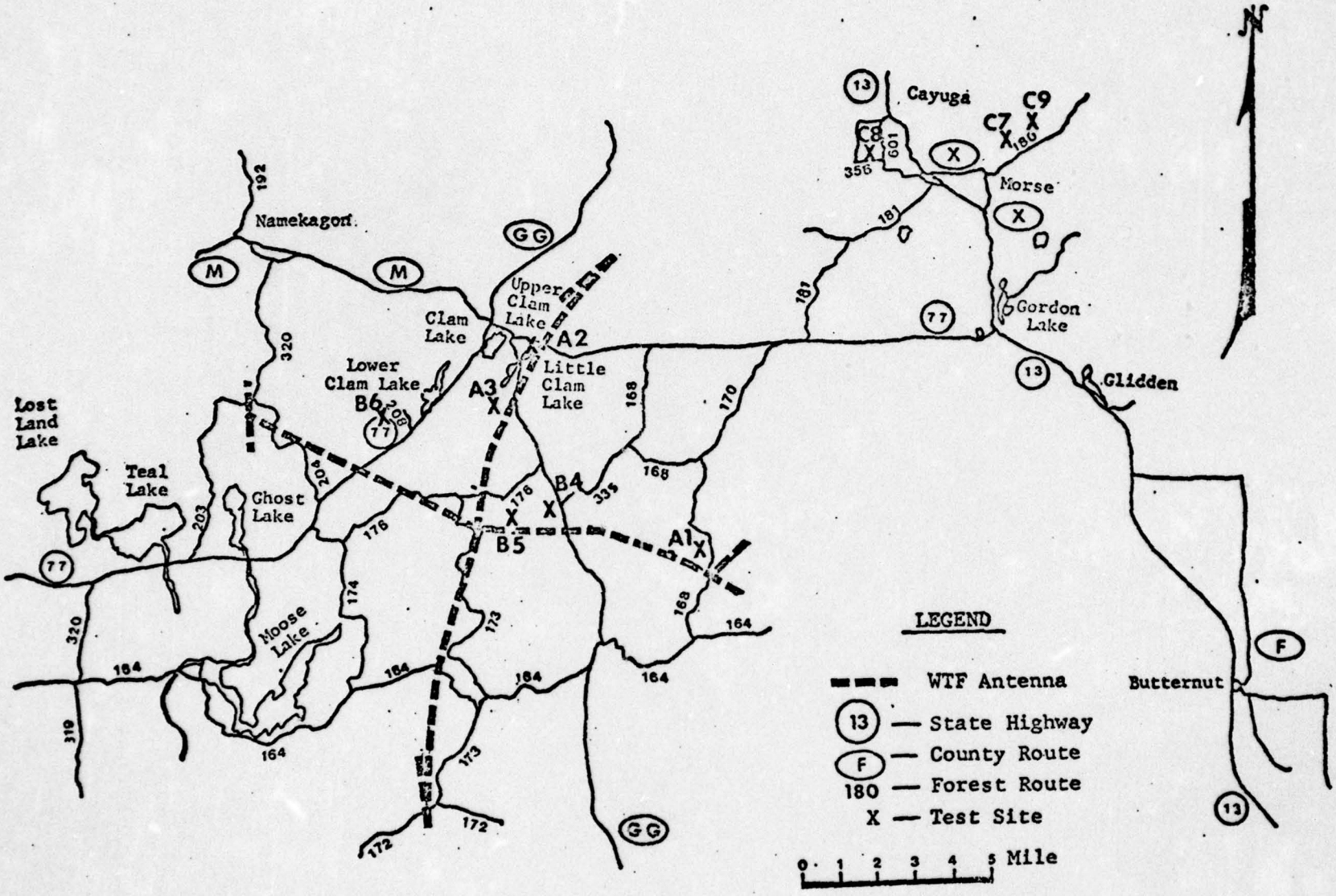


Table 1

Site Classification for the Wisconsin Test Facility Ecological Survey

Site	Kind	Remarks
A1	Spruce-fir	Adjacent to Antenna
A2	Hardwood	Adjacent to Antenna
A3	Pine	Adjacent to Antenna
B4	Spruce-fir	Adjacent to Power Line Near Antenna
B5	Hardwood	Adjacent to Power Line Near Antenna
B6	Pine	Adjacent to Buried Power Line Near Antenna
C7	Spruce-fir	Adjacent to Power Line Far From Antenna
C8	Hardwood	Adjacent to Power Line Far From Antenna
C9	Pine	Adjacent to Pipe Line Far From Antenna

Table 2

Measured Field Levels at Site Locations for the WTF Ecological Survey

	Electric Field (Volts/Meter)**					Magnetic Field (gauss)**				
	45 Hz		75 Hz			45 Hz		75 Hz		
Site	E/W*	N/S*	E/W	N/S	60 Hz	E/W	N/S	E/W	N/S	60 Hz
A1	0.140		0.114		0.00003			0.08		0.00003
A2	0.00001	0.084			0.0001	0.00006	0.05			<0.00001
A3		0.160			0.00006	0.00011	0.07			<0.00001
B4			0.065		0.00022			0.00048		0.00043
B5			0.048	0.072	0.00038			0.0067	0.0063	0.00021
B6			1.5***	0.33	0.019	0.001	0.00014	0.0016	0.00032	<0.00001
C7	0.001	0.00086	0.00066	0.00076	0.00092			<0.00001	<0.00001	0.00004
C8	0.0017	0.0015	0.00076	0.00086	0.0033			0.00007		0.00024
C9	0.00072	0.0011	0.00069	0.00076	0.00049			0.00029	0.00029	0.00006

*E/W or N/S indicates East-West or North-South Antenna in Operation

**All fields for 300 A. antenna current.

***The large localized 75 Hz fields at Site B6 are caused by proximity to a buried power line.

Table 3

Dominant Species in the Antenna Right-of-Way
at Site A1 for the WTF Ecological Survey

Species	Average Cover in Percent
Carex pensylvanica	6.16
Carex sp_2	1.25
Festuca elatior	0.66
Poa sp_1	1.58
Trifolium repens	36.41

Species	Relative Density, %	Relative Frequency, %	Relative Importance, %
Hieracium aurantiacum	24	8	32
Rumex acetosella	16	6	22
Cornus canadensis	16	8	24
Uvularia grandiflora	12	6	18
Rubus indaeus	11	10	21
Maianthemum canadense	5	5	10
Galium trifolium	3	6	9
Cirsium muticum	3	8	11
Convolvulus spithameus	2	6	8
Anaphilis margaritacea	2	3	5
Clintonia borealis	1	4	5
Acer saccharum	1	8	9
Diervilla lonicera	1	4	5
Trillium grandiflorum	1	3	4
Achillea millifolium	1	3	4
Ostrya virginiana	1	4	5
Taraxacum officinale	0.4	2	2.4
Pteridium aquilinum	0.3	3	3.3
Plantago rugelii	0.3	2	2.3
Populus tremuloides	0.2	2	2.2
Prunus serotina	0.2	2	2.2
Total	101.4	99	200.4

Table 4

Dominant Species Distribution in the Antenna Right-of-Way at Site A1 for the WTF Ecological Survey

Species	Cover, % 0-1 meter A	0-1 meter B	1-2 meters A	1-2 meters B	2-3 meters A	2-3 meters B
Carex pensylvanica	0	0	1	1	15	20
Carex sp_2	4	10	0	0	0	0
Festuca elatior	0	0	0	0	0	5
Trifolium repens	90	80	85	80	60	40
	Relative Density, %					
Rubus idaeus	1	5	22	9	10	13
Cirsium muticum	2	3	0	0	3	4
Acer saccharum	4	2	0	0	0	0
Hieracium aurantiacum	93	90	53	71	28	24
Galium triflorum	0	0	5	3	0	0
Pteridium aquilinum	0	0	3	0	1	1
Plantago rugelii	0	0	3	6	0	0
Achillea millifolium	0	0	8	8	0	0
Rumex acetosella	0	0	6	3	51	53
Cornus canadensis	0	0	0	0	6	4
Convolvulus spithameus	0	0	0	0	1	1
Total	100	100	100	100	100	100

Species	Cover, % 3-4 meters A	3-4 meters B	4-5 meters A	4-5 meters B	5-6 meters A	5-6 meters B
Carex pensylvanica	5	5	10	10	2	5
Festuca elatior	0	0	1	2	0	0
Poa sp_1	5	10	1	3	0	0
Trifolium repens	1	1	0	0	0	0
	Relative Density, %					
Rubus idaeus	18	31	11	7	0	0
Cirsium muticum	6	6	2	1	0	0
Acer saccharum	1	2	1	1	2	1
Hieracium aurantiacum	26	17	0	0	0	0
Galium triflorum	0	0	5	14	2	4
Rumex acetosella	15	13	0	0	0	0
Cornus canadensis	9	8	29	22	49	45
Convolvulus spithameus	7	4	4	3	0	0
Populus tremuloides	1	1	0	0	0	0
Anaphilis margaritacea	8	7	0	0	0	0
Diervilla lonicera	2	3	0	0	4	3
Prunus serotina	1	2	0	0	0	0
Ostrya virginiana	2	1	0	0	1	1
Uvularia grandiflora	4	5	27	34	22	26
Maianthemum canadense	0	0	15	14	14	10
Trillium grandiflorum	0	0	3	1	0	0
Taraxacum officinale	0	0	1	2	0	0
Clintonia borealis	0	0	2	1	6	10
Total	100	100	100	100	100	100

Table 5

Dominant Species in the Surrounding Forest at Site A1
for the WTF Ecological Survey

Species	Relative Frequency, %	Relative Density, %	Relative Dominance, %	Relative Importance, %
Abies balsamea	58	65	72	195
Acer saccharum	23	22	14	59
Betula papyrifera	15	11	12	38
Prunus serotina	4	2	2	8

Table 6

Dominant Species in the Surrounding Forest at Site B4
for the WTF Ecological Survey

Species	Relative Frequency, %	Relative Density, %	Relative Dominance, %	Relative Importance, %
Picea mariana	32	18	22	72
Abies balsamea	45	67	56	168
Populus tremuloides	23	15	22	60

Table 7

Dominant Species in the Power Line Right-of-Way at Site B4
for the WTF Ecological Survey

Species	Average Cover, %		
Carex pensylvanica	21.66		
	Relative Density, %	Relative Frequency, %	Relative Importance, %
Viola pallens	21	7	28
Maianthemum canadense	15	8	23
Equisetum sylvaticum	10	8	18
Fragaria virginiana	9	8	17
Aster macrophyllus	8	8	16
Cornus canadensis	6	5	11
Rubus idaeus	5	5	10
Juncus tenuis	4	7	11
Trientalis borealis	4	3	7
Coptis groenlandica	2	3	5
Lycopodium obscurum	2	4	6
Populus tremuloides	2	7	9
Alnus rugosa	2	1	3
Clintonia borealis	2	3	5
Asclepias syriaca	2	1	3
Viburnum sp.	1	2	3
Abies balsamea	1	4	5
Iris versicolor	1	1	2
Vaccinium angustifolium	1	3	4
Rumex acetosella	1	1	2
Picea mariana	0.4	2	2.4
Galium trifolium	0.3	1	1.3
Aralia nudicaulis	0.3	1	1.3
Anemone quinquefolia	0.3	2	2.3
Prunus serotina	0.3	2	2.3
Acer saccharum	0.1	1	1.1
Anemone virginiana	0.1	1	1.1
Total	100.8	99	199.8

Dominant Species Distribution in the Power Line Right-of-Way at Site B4 for the WTF Ecological Survey

Species	Cover, % 0-1 meter A	0-1 meter B	1-2 meters A	1-2 meters B	2-3 meters A	2-3 meters B
Carex pensylvanica	40	40	40	20	30	60
	Relative Density, %					
Aster macrophyllus	8	9	2	7	4	1
Viola pallens	42	30	35	27	32	18
Rubus idaeus	17	14	12	12	7	1
Fragaria virginiana	11	20	12	17	6	12
Equisetum sylvaticum	4	6	5	11	26	27
Maianthemum canadense	3	7	20	7	7	15
Clintonia borealis	9	7	0	3	2	0
Populus tremuloides	5	3	2	0	1	0
Juncus tenuis	1	3	0	4	3	1
Anemone quinquefolia	0	1	4	0	0	0
Iris versicolor	0	0	7	11	0	0
Cornus canadensis	0	0	0	0	6	9
Rumex acetosella	0	0	0	0	2	6
Abies balsamea	0	0	0	0	3	5
Coptis groenlandica	0	0	0	0	1	0
Galium trifolium	0	0	0	0	0	5
Total	100	100	99	99	100	100

Species	Cover, % 3-4 meters A	3-4 meters B	4-5 meters A	4-5 meters B	5-6 meters A	5-6 meters B
Carex pensylvanica	10	20				
	Relative Density, %					
Aster macrophyllus	7	3	15	2	33	7
Viola pallens	4	25	5	8	0	0
Rubus idaeus	2	3	0	0	0	0
Fragaria virginiana	2	12	9	16	1	5
Equisetum sylvaticum	3	5	4	13	1	12
Maianthemum canadense	36	12	14	20	11	27
Clintonia borealis	0	3	0	0	0	0
Populus tremuloides	4	1	2	1	2	2
Juncus tenuis	3	3	13	6	3	3
Cornus canadensis	14	6	7	6	13	7
Abies balsamea	1	0	1	1	4	0
Trientalis borealis	7	3	18	6	0	0
Viburnum sp.	6	5	0	0	0	0
Vaccinium angustifolium	3	0	1	1	1	2
Anemone virginiana	0	1	0	0	0	0
Picea mariana	1	0	0	5	1	0
Alnus rugosa	3	15	0	0	0	0
Aralia nudicaulis	0	1	0	0	0	0
Lycopodium obscurum	4	3	2	2	10	8
Achillea millefolium	0	0	2	0	0	0
Acer saccharum	0	0	1	0	0	0
Coptis groenlandica	0	0	3	14	0	17
Prunus serotina	0	0	2	0	1	0
Asclepias syriaca	0	0	0	0	19	9
Total	100	101	99	101	100	99

Table 9

Dominant Species in the Power Line Right-of-Way
at Site C7 for the WTF Ecological Survey

Species	Average Cover, %		
Lolium multiflorum	35.33		
Carex pensylvanica	6.75		
	Relative Density, %	Relative Frequency, %	Relative Importance, %
Hieracium aurantiacum	31	9	40
Cornus canadensis	30	9	39
Maianthemum canadense	14	11	25
Aira elegans	5	5	10
Gaultheria procumbens	4	5	9
Lycopodium obscurum	4	4	8
Abies balsamea	3	5	8
Rubus idaeus	1	7	8
Aster macrophyllus	2	5	7
Fragaria virginiana	1	5	6
Viola pallens	1	5	6
Picea mariana	1	5	6
Ranunculus acris	1	4	5
Achillea millefolium	0.3	4	4.3
Alnus rogosa	1	3	4
Coptis groenlandica	1	3	4
Clintonis borealis	0.2	2	2.2
Prunus serotina	0.2	2	2.2
Anaphalis margaritacea	0.1	2	2.1
Linaria vulgaris	0.1	2	2.1
Hieracium pilosella	0.1	1	1.1
Diervilla lonicera	0.1	1	1.1
Total	101.1	99	200.1

Table 10

Dominant Species Distribution in the Power Line Right-of-Way at Site C7 for the WTF Ecological Survey

Species	Cover, % 0-1 meter A	0-1 meter B	1-2 meters A	1-2 meters B	2-3 meters A	2-3 meters B
Lolium multiflorum	95	95	95	80	20	20
Carex pensylvanica	2	0	3	1	20	15
	Relative Density, %					
Cornus canadensis	70	19	0	0	4	15
Maianthemum canadense	30	13	80	10	75	31
Rubus idaeus	0	12	0	10	4	3
Hieracium aurantiacum	0	37	20	30	0	12
Fragaria virginiana	0	19	0	50	0	5
Aster macrophyllus	0	0	0	0	0	4
Achillea millefolium	0	0	0	0	0	5
Gaultheria procumbens	0	0	0	0	6	1
Aira elegans	0	0	0	0	8	21
Hieracium pilosella	0	0	0	0	0	0
Viola pallens	0	0	0	0	0	0
Alnus rugosa	0	0	0	0	0	0
Linaria vulgaris	0	0	0	0	0	0
Abies balsamea	0	0	0	0	0	0
Picea mariana	0	0	0	0	0	0
Lycopodium obscurum	0	0	0	0	0	0
Ranunculus acris	0	0	0	0	0	0
Coptis groenlandica	0	0	0	0	3	3
Anaphalis margaritacea	0	0	0	0	0	0
Clintonia borealis	0	0	0	0	0	0
Diervilla lonicera	0	0	0	0	0	0
Prunus serotina	0	0	0	0	0	0
Total	100	100	100	100	100	100

Table 10 (Cont'd.)

Species	Cover, % 3-4 meters A	3-4 meters B	4-5 meters A	4-5 meters B	5-6 meters A	5-6 meters B
Lolium multiflorum	5	5	1	2	5	1
Carex pensylvanica	20	10	1	5	2	2
			Relative Density, %			
Cornus canadense	11	10	33	42	34	28
Maianthemum canadense	14	6	21	8	9	7
Rubus idaeus	0	1	0	1	1	1
Hieracium aurantiacum	36	39	29	34	32	33
Fragaria virginiana	0	0	1	1	1	2
Aster macrophyllus	0	0	1	2	1	2
Achillea millefolium	0	0	0	0	1	1
Gaultheria procumbens	0	0	1	1	4	10
Aira elegans	15	23	4	2	0	0
Hieracium pilosella	0	0	0	0	0	0
Viola pallens	2	1	1	1	1	1
Alnus rugosa	0	2	0	0	1	1
Linaria vulgaris	0	1	0	0	1	0
Abies balsamea	11	8	2	1	2	5
Picea mariana	2	2	1	1	1	1
Lycopodium obscurum	0	5	5	5	6	2
Ranunculus acris	7	0	1	1	2	2
Coptis groenlandica	2	2	0	0	0	0
Anaphalis margaritacea	0	0	0	0	1	1
Clintonia borealis	0	0	0	0	1	1
Diervilla lonicera	0	0	0	0	0	1
Prunus serotina	0	0	0	0	1	1
Total	100	100	100	100	100	100

Table 11

Relative Density of Dominant Species in the Surrounding Forest at Site C7 for the WTF Ecological Survey

Species	Relative Density, %							
	6-16 meters		16-26 meters		26-36 meters		36-46 meters	
	a	b	c	d	e	f	g	h
Abies balsamea	100	83	82	50	50	0	33	33
Picea mariana	0	17	0	0	0	25	0	0
Alnus rugosa	0	0	0	0	50	0	67	0
Thuja occidentalis	0	0	16	50	0	75	0	67

	46-56 meters		56-66 meters		66-76 meters	
	i	j	k	l	m	n
Abies balsamea	82	40	69	86	64	80
Picea mariana	0	0	8	0	9	0
Alnus rugosa	0	20	15	0	0	0
Thuja occidentalis	16	40	8	14	25	20

	76-86 meters		86-96 meters		96-106 meters	
	o	p	q	r	s	t
Abies balsamea	20	25	50	56	70	100
Picea mariana	0	0	0	0	0	0
Alnus rugosa	0	0	0	0	30	0
Thuja occidentalis	80	75	50	44	0	0

Table 12

Relative Dominance of Dominant Species in the Surrounding Forest at Site C7 for the WTF Ecological Survey

	Relative Dominance, %							
	6-16 meters		16-26 meters		26-36 meters		36-46 meters	
Species	a	b	c	d	e	f	g	h
Abies balsamea	100	75	76	34	62	0	62	39
Picea mariana	0	25	0	0	0	10	0	0
Alnus rugosa	0	0	0	0	38	0	38	0
Thuja occidentalis	0	0	24	66	0	90	0	61

	46-56 meters		56-66 meters		66-76 meters	
	i	j	k	l	m	n
Abies balsamea	67	34	59	55	41	60
Picea mariana	0	0	11	0	8	0
Alnus rugosa	0	6	8	0	0	0
Thuja occidentalis	33	60	22	45	51	40

	76-86 meters		86-96 meters		96-106 meters	
	o	p	q	r	s	t
Abies balsamea	10	12	31	34	87	100
Picea mariana	0	0	0	0	0	0
Alnus rugosa	0	0	0	0	13	0
Thuja occidentalis	90	88	69	66	0	0

Table 13

Dominant Species in the Surrounding Forest at Site C7
for the WTF Ecological Survey

Species	Grouped Data			
	Relative Frequency, %	Relative Density, %	Relative Dominance, %	Relative Importance, %
Abies balsamea	44	62	49	155
Picea mariana	9	3	3	15
Alnus rugosa	12	9	3	24
Thuja occidentalis	35	26	45	106

Table 14

Dominant Species in the Antenna Right-of-Way at Site A2
for the WTF Ecological Survey

Species	Average Cover, %
Carex pensylvanica	5.00
Carex sp_1	0.75
Carex sp_2	6.75
Festuca elatior	2.50
Poa sp_1	4.16
Poa sp_2	1.75
Trifolium repens	31.58
Melilotus sp	0.92

Species	Relative Density, %	Relative Frequency, %	Relative Importance, %
Aster macrophylla	29	9	38
Plantago rugelii	15	15	30
Rumex acetosella	12	6	18
Chrysanthemum leucanthemum	11	9	20
Cirsium muticum	10	9	19
Anaphilis margaritacea	6	6	12
Acer saccharum	4	15	19
Achillea millifolium	3	6	9
Ranunculus acris	3	3	6
Pteridium aquilinum	2	3	5
Verbascum thapsus	2	3	5
Prunus serotina	1	6	7
Convolvulus spithameus	1	3	4
Rubus idaeus	1	3	4
Taraxacum officianale	1	3	4
Total	101	99	200

Table 15

Dominant Species Distribution in the Antenna Right-of-Way at Site A2 for the WTF Ecological Survey

Species	Cover, % 0-1 meter A	0-1 meter B	1-2 meters A	1-2 meters B	2-3 meters A	2-3 meters B
Carex sp_1	0	0	0	2	2	5
Festuca elatior	2	1	0	0	0	0
Poa sp_1	0	0	0	0	10	5
Poa sp_2	0	0	1	5	10	5
Trifolium repens	95	95	95	49	4	2
Melilotus sp_1	0	0	1	10	0	0
Relative Density, %						
Plantago rugelii	50	56	75	87	8	10
Prunus serotina	33	11	0	0	0	0
Acer saccharum	17	33	25	13	8	5
Rumex acetosella	0	0	0	0	20	68
Cirsium muticum	0	0	0	0	48	7
Chrysanthemum leucanthemum	0	0	0	0	4	8
Asclepias syriaca	0	0	0	0	12	2
Total	100	100	100	100	100	100

Species	Cover, % 3-4 meters A	3-4 meters B	4-5 meters A	4-5 meters B	5-6 meters A	5-6 meters B
Carex pensylvanica	0	0	0	0	30	30
Carex sp_2	1	5	20	40	10	5
Festuca elatior	10	12	1	1	1	2
Poa sp_1	7	5	10	5	5	3
Trifolium repens	20	15	1	10	1	1
Relative Density, %						
Plantago rugelii	26	17	15	9	0	0
Prunus serotina	0	0	0	0	5	2
Acer saccharum	0	0	4	5	3	2
Rumex acetosella	8	18	0	0	0	0
Cirsium muticum	17	13	6	10	0	0
Chrysanthemum leucanthemum	12	44	0	0	3	5
Taraxacum officianale	3	1	0	0	0	0
Convolvulus spithameus	5	3	0	0	0	0
Aster macrophyllus	9	3	47	56	58	71
Anaphalis margaritacea	20	1	4	7	0	0
Verbascum thapsus	0	0	10	5	0	0
Rubus idaeus	0	0	6	2	0	0
Achillea millifolium	0	0	8	6	8	3
Pteridium aquilinum	0	0	0	0	10	0
Ranunculus acris	0	0	0	0	13	10
Total	99	101	99	100	100	101

Table 16

Dominant Species in the Power Line Right-of-Way at Site B5
for the WTF Ecological Survey

Species	Average Cover, %
Carex sp_2	9.3
Poa sp_1	6.9
Carex sp_3	6.0
Carex pensylvanica	1.5
Carex sp_4	0.3
Carex sp_5	0.3

Species	Relative Density, %	Relative Frequency, %	Relative Importance, %
Aster macrophyllus	47	18	65
Rubus idaeus	26	15	41
Fragaria virginiana	8	11	19
Rubus allegheniensis	7	16	23
Convolvulus spithameus	3	10	13
Prunus serotina	2	6	8
Asclepias syriaca	2	3	5
Diervilla lonicera	2	7	9
Pteridium aquilinum	1	4	5
Anaphilis margaritacea	1	1	2
Ostrya virginiana	1	3	4
Populus grandidentata	0.2	2	2.2
Populus tremuloides	0.2	2	2.2
Cirsium muticum	0.2	1	1.2
Total	100.6	99	199.6

Table 17

Dominant Species Distribution in the Power Line Right-of-Way at Site B5 for the WTF Ecological Survey

Species	Cover, % 0-1 meter A	0-1 meter B	1-2 meters A	1-2 meters B	2-3 meters A	2-3 meters B
Carex pensylvanica	5	10	1	1	1	0
Carex sp_2	20	10	20	20	5	5
Carex sp_3	0	0	10	5	1	1
Carex sp_4	0	0	1	1	0	0
Carex sp_5	0	0	0	0	2	0
Poa sp_1	5	5	2	25	15	5
	Relative Density, %					
Fragaria virginiana	5	37	5	20	9	25
Convolvulus spithameus	3	13	0	0	2	4
Aster macrophyllus	45	13	30	20	18	15
Rubus idaeus	39	31	59	48	43	28
Rubus allegheniensis	1	0	3	4	11	17
Populus tremuloides	1	0	0	0	0	0
Populus grandidentata	0	3	0	0	0	0
Diervilla lonicera	0	3	3	0	4	11
Anaphilis margaritacea	5	0	0	0	0	0
Asclepias syriaca	0	0	0	7	14	0
Total	99	100	100	99	101	100

	Cover, % 3-4 meters A	3-4 meters B	4-5 meters A	4-5 meters B	5-6 meters A	5-6 meters B
Carex sp_2	10	5	5	5	5	2
Carex sp_3	25	20	0	10	0	0
Carex sp_4	2	0	0	0	0	0
Carex sp_5	0	0	1	1	0	0
Poa sp_1	15	1	10	0	0	0
	Relative Density, %					
Fragaria virginiana	0	11	0	0	0	0
Convolvulus spithameus	8	3	0	13	0	0
Aster macrophyllus	55	43	86	39	81	82
Rubus idaeus	25	31	2	13	0	0
Rubus allegheniensis	6	3	8	6	12	11
Diervilla lonicera	0	0	0	0	1	0
Prunus serotina	2	9	5	29	0	0
Pteridium aquilinum	4	0	0	0	2	3
Ostrya virginiana	0	0	0	0	3	2
Lycopodium obscurum	0	0	0	0	1	0
Cirsium muticum	0	0	0	0	0	2
Total	100	100	101	100	100	100

Table 18

Dominant Species in the Power Line Right-of-Way at Site C8
for the WTF Ecological Survey

Species	Cover, %
Calamagrostis canadensis	11.50
Poa pratensis	11.91
Carex pensylvanica	1.08
Phleum pratense	0.66

Species	Relative Density, %	Relative Frequency, %	Relative Importance, %
Aster macrophyllus	24	6	30
Hieracium aurantiacum	19	6	25
Solidago canadensis	12	6	18
Viola pallens	8	5	13
Fragaria virginiana	5	5	10
Achillea millifolium	5	5	10
Pteridium aquilinum	4	6	10
Acer saccharum	3	6	9
Maianthemum canadense	3	5	8
Anaphalis margaritacea	4	3	7
Corylus cornuta	2	4	6
Taraxacum officinale	1	4	6
Rumex acetosella	1	4	6
Aralia nudicaulis	1	4	6
Abies balsamea	1	4	6
Rubus idaeus	1	3	4
Rubus allegheniensis	1	3	4
Geum aleppicum	1	3	4
Ostrya virginiana	1	3	4
Uvularia grandiflora	1	2	3
Corylus americana	0.4	2	2.4
Apocynum androsaemifolium	0.4	2	2.4
Diervilla lonicera	0.3	2	2.3
Juncus tenuis	0.4	1	1.4
Ribes cynosbati	0.3	1	1.3
Fraxinus pennsylvanica	0.2	1	1.2
Salix humilis	0.2	1	1.2
Chrysanthemum leucanthemum	0.1	1	1.1
Populus tremuloides	0.1	1	1.1
Quercus rubra	0.1	1	1.1
Plantago rugellii	0.1	1	1.1
Total	100.6	101	205.6

Table 19

Dominant Species Distribution in the Power Line Right-of-Way at Site C8 for the WTF Ecological Survey

Species	0-1 meter		1-2 meters		2-3 meters		3-4 meters		4-5 meters		5-6 meters	
	A	B	A	B	A	B	A	B	A	B	A	B
Cover, %												
Calamagrostis canadensis	35	25	5	5	1	1	1	2	1	2	35	25
Poa pratensis	2	30	15	30	5	5	10	15	15	10	1	5
Carex pensylvanica	0	0	0	0	0	0	1	2	5	2	1	2
Phleum pratense	0	0	0	0	2	4	1	0	0	1	0	0
Relative Density, %												
Pteridium aquilinum	8	7	1	6	3	3	2	3	1	4	1	4
Solidago canadensis	26	18	16	12	6	7	8	6	4	15	12	18
Anaphalis margaritacea	6	11	2	6	1	4	0	12	0	0	0	0
Acer saccharum	1	3	3	3	3	3	5	6	2	2	9	1
Rubus idaeus	6	1	2	0	1	1	1	0	0	1	0	0
Rubus allegheniensis	1	0	1	0	0	1	0	0	2	1	1	0
Corylus cornuta	0	1	1	5	0	2	11	2	1	0	0	1
Aster macrophyllus	6	15	12	17	15	14	27	31	38	31	46	42
Viola pallens	15	12	5	7	5	10	6	5	5	10	4	12
Hieracium aurantiacum	8	14	32	24	39	19	18	14	23	9	10	7
Fragaria virginiana	5	6	6	3	7	7	4	5	9	3	1	2
Taraxacum officinale	1	1	1	1	0	0	1	1	0	2	0	2
Rumex acetosella	5	3	1	1	2	1	0	2	1	0	0	1
Maianthemum candense	7	4	1	2	1	0	7	0	3	4	3	4
Aposynum androsaemifolium	1	1	0	0	1	2	0	0	1	0	0	0
Aralia nudicaulis	2	2	0	1	0	1	1	3	0	1	1	1
Geum aleppicum	1	0	2	1	1	0	1	0	1	1	4	2
Corylus americana	1	1	1	0	0	2	0	0	0	1	0	0
Achillea millifolium	0	1	3	9	9	13	4	6	5	6	4	0
Plantago rugellii	0	0	1	0	0	1	0	0	0	0	0	0
Abies balsamea	0	0	2	1	1	1	1	0	1	1	1	0
Quercus rubra	0	0	1	1	0	0	0	0	0	0	0	0
Populus tremuloides	0	0	1	0	0	0	0	0	0	0	0	0
Ostrya virginiana	0	0	4	1	1	3	1	1	0	0	0	0
Diervilla lonicera	0	0	1	0	0	0	0	1	1	1	0	0
Salix humilis	0	0	0	0	1	1	0	0	0	0	0	0
Uvularia grandiflora	0	0	0	0	2	2	2	3	1	4	0	1
Chrysanthemum leucanthemum	0	0	0	0	1	0	0	0	0	0	0	0
Juncus tenuis	0	0	0	0	1	2	0	0	0	2	0	0
Fraxinus pennsylvanica	0	0	0	0	0	0	0	0	1	0	0	2
Ribes cynosbati	0	0	0	0	0	0	0	0	0	1	3	1
Total	100	101	100	101	101	100	100	101	100	100	100	101

Table 20

Relative Density of Dominant Species in the Surrounding Forest at Site C8 for the WTF Ecological Survey

	Meters																			
	6-16		16-26		26-36		36-46		46-56		56-66		66-76		76-86		86-96		96-106	
Species	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t
Acer saccharum	100	50	83	83	100	88	100	83	78	100	100	100	100	89	100	80	25	100	83	89
Betula lubea	0	8	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	17	0
Fraxinus pennsylvanica	0	0	0	0	0	0	0	0	11	0	0	0	0	11	0	10	0	0	0	0
Prunus serotina	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ostrya virginiana	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	75	0	0	11
Tilia americana	0	42	0	17	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0
Quercus alba	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0

Table 21

Relative Dominance of Dominant Species in the Surrounding Forest at Site C8 for the WTF Ecological Survey

	Meters																			
	6-16		16-26		26-36		36-46		46-56		56-66		66-76		76-86		86-96		96-106	
Species	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t
Acer saccharum	100	9	87	54	100	79	100	40	75	100	100	100	100	85	100	46	7	100	78	88
Betula lutea	0	12	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0	0	32	0
Fraxinus pennsylvanica	0	0	0	0	0	0	0	0	6	0	0	0	0	15	0	16	0	0	0	0
Prunus serotina	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ostrya virginiana	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	93	0	0	12
Tilia americana	0	79	0	46	0	0	0	0	0	0	0	0	0	0	0	38	0	0	0	0
Quercus alba	0	0	0	0	0	0	0	60	0	0	0	0	0	0	0	0	0	0	0	0

Table 22

Dominant Species in the Surrounding Forest at Site C8
for the WTF Ecological Survey

Species	Relative Frequency, %	Relative Density, %	Relative Dominance, %	Relative Importance, %
Acer saccharum	64	85	75	224
Betula lutea	9	2	4	15
Fraxinus pennsylvanica	6	2	2	10
Prunus serotina	3	1	1	5
Ostrya virginiana	9	5	5	19
Tilia americana	6	4	11	21
Quercus alba	3	1	2	6

Table 23

Dominant Species in the Surrounding Forest at Site A2
for the WTF Ecological Survey

Species	Relative Frequency, %	Relative Density, %	Relative Dominance, %	Relative Importance, %
Acer saccharum	63	75	75	213
Ostrya virginiana	30	18	10	58
Quercus rubra	3	6	13	22
Populus tremuloides	4	1	2	7

Table 24

Dominant Species in the Surrounding Forest at Site B5
for the WTF Ecological Survey

Species	Relative Frequency, %	Relative Density, %	Relative Dominance, %	Relative Importance, %
Acer saccharum	52	70	65	187
Populus tremuloides	10	7	6	23
Ostrya virginiana	7	3	3	13
Pinus strobus	10	5	14	29
Abies balsamea	14	12	3	29
Betula papyrifera	7	3	9	19

Table 25

Dominant Species Distribution of the Surrounding Forest at Site B4 for the WTF Ecological Survey

	Relative Density, %																			
	Meters																			
	6-16		16-26		26-36		36-46		46-56		56-66		66-76		76-86		86-96		96-106	
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Picea mariana	50	0	33	50	17	25	38	14	0	0										
Abies balsamea	12	100	50	50	50	50	50	86	100	100										
Populus tremuloides	38	0	17	0	33	12	12	0	0	0										

Table 26

Dominant Species Distribution of the Surrounding Forest Site A1 for the WTF Ecological Survey

	Relative Density, %																			
	Meters																			
	6-16		16-26		26-36		36-46		46-56		56-66		66-76		76-86		86-96		96-106	
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Abies balsamea	80	100	0	0	0	100	100	33	100	0	100	25	57	40	0	100	100	100	100	75
Acer saccharum	0	0	0	0	0	0	0	33	0	100	0	75	14	20	0	0	0	0	0	25
Betula papyrifera	20	0	0	0	0	0	0	34	0	0	0	0	29	20	0	0	0	0	0	0
Prunus serotina	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0

Table 27

Dominant Species Distribution of the Surrounding Forest at Site B5 for the WTF Ecological Survey

	Relative Density, % Meters																			
	6-16		16-26		26-36		36-46		46-56		56-66		66-76		76-86		86-96		96-106	
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Acer saccharum	0	50	60	100	100	100	100	100	100	0	67	67	50	100						
Populus tremuloides	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
Ostrya virginiana	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
Pinus strobus	0	0	0	0	0	0	0	0	0	0	33	16	50	0						
Abies balsamea	0	50	40	0	0	0	0	0	0	0	0	0	0	0						
Betula papyrifera	100	0	0	0	0	0	0	0	0	0	0	17	0	0						

Table 28

Dominant Species Distribution of the Surrounding Forest at Site A2 for the WTF Ecological Survey

	Relative Density, % Meters																			
	6-16		16-26		26-36		36-46		46-56		56-66		66-76		76-86		86-96		96-106	
Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Acer saccharum	20	75	100	100	33	88	67	67	100	100	80	100	50	67	100	100	100	100	0	75
Ostrya virginiana	80	25	0	0	67	12	0	33	0	0	20	0	50	33	0	0	0	0	100	0
Quercus rubra	0	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0
Populus tremuloides	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25

Table 29

Pine Bud Mortality in Percent for the WTF Ecological Survey

Site	Distance from Right-of-Way in Meters				
	0-10	10-20	20-30	30-40	40-50
Site C9 (Red pine)	6	4	3	2	0
Replicate Sample	4	3	4	0	0
Site B6 (White pine)	9	3	11	7	2
Site A5 (White pine)	8	3	3	4	4
Replicate Sample	6	1	3	5	4